Abstract Submitted
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Shock-initiated Combustion with New Insights into the Nature of the Shock-focusing Phenomenon[1] NICHOLAS HAEHN, CHRISTOPHER WEBER, JASON OAKLEY, DAVID ROTHAMER, University of Wisconsin-Madison, DEVESH RANJAN, Texas A&M University, RICCARDO BONAZZA, University of Wisconsin-Madison — Shock-focusing that results from the interaction of a planar shock wave with a spherical density inhomogeneity is used to ignite a reactive mixture of gases. Due to the singular nature of this process, the task of quantifying the effect of the shock-focusing is challenging from a numerical and analytical point of view. As such, there is a lack of understanding regarding the thermodynamic conditions that are achieved during the shock-focusing process. These conditions, and this process in general, are important to a wide range of disciplines, including inertial confinement fusion, astrophysics, and supersonic combustion. A bubble is prepared using a stoichiometric mixture of fuel and oxidizer and diluted with Xe, which increases the overall density of the mixture. The experiments are performed in the Wisconsin Shock Tube Laboratory (WiSTL) in a 9.2 m vertical shock tube with a 25.4 cm $\times$g5.4 cm square cross-section. The bubble is accelerated by a planar shock wave ($2.0 < \quad M \quad < 2.8$). Planar Mie scattering and chemiluminescence are used simultaneously to visualize the bubble morphology and combustion characteristics. In turn, the combustion can be used as a diagnostic to assess the conditions that exist near the shock-focusing region.

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